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Revision of the South African endemic genus *Edenophorus* Smith (Diptera: Empididae)

by

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ABSTRACT

The South African endemic genus *Edenophorus* Smith is revised and includes the following seven species: *E. hiemalis* sp. n., *E. irwini* sp. n., *E. knysna* Smith, *E. nigricans* sp. n., *E. simplex* sp. n., *E. spinosus* sp. n, and *E. stuckenbergi* sp. n. The genus is assigned to the Empidinae on the basis of wing venation and the male terminalia, but lacks a strongly arched maxillary palpus characteristic of the Empidini *s.s.*, Hilarini and *Empidadelpha* Collin.

INTRODUCTION

Presently nine genera and 95 % of all known species of Empidoidea (exclusive of Dolichopodidae) in South Africa are endemic. In most cases, the phylogenetic relationships with taxa outside this region remain unknown. The endemic South African genus *Edenophorus* Smith is no exception. It was first erected by Smith (1969) based on two female specimens and assigned to the *Microphorus* group of genera (i.e., Microphorinae). It was this controversial assignment that has drawn the attention of empidoid researchers. Chvála (1981), on the basis of wing venation considered it more closely related to the Ocydromiinae. More recently, Ulrich (1994) found strong evidence for its assignment to the Empididae *s.s.*, and it is currently assigned to the Empidinae principally on the basis of the male terminalia (Sinclair & Cumming, unpubl. data).

In his presentation, Ulrich (1994) displayed one male and one female (Fig. 1) specimen. The female is included in this study and identified as *E. knysna* Smith. However, the male appears not to be congeneric with *Edenophorus*, as it lacks the two postpronotal bristles, the proboscis arises more centrally on the head, the M vein is unbranched, and the wing membrane is clothed in long microtrichia. Two additional specimens of this apparently undescribed genus are housed in the Natal Museum, Pietermaritzburg.

This study is based on 14 specimens, with three species based only on females. A greater diversity and number of specimens are expected with more extensive sampling of humid forests and montane Fynbos regions. *Edenophorus* is probably a flower visitor, as pollen was observed in the gut of a dissected male abdomen. The mouthparts, particularly the presence of epipharyngeal blades, are typical of the Empidinae, where species are known to be both flower visitors and predators of flying insects during mating periods (Daugeron 1997).

MATERIALS AND METHODS

This study was based on the examination of 14 adult specimens borrowed or deposited in the following institutions: The Natural History Museum, London, UK (BMNH); the

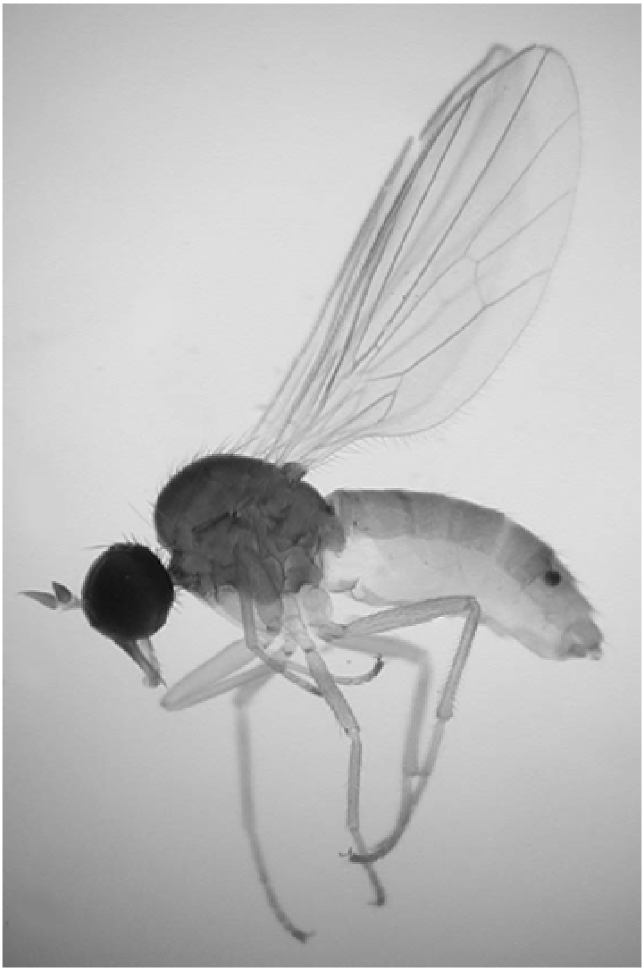


Fig. 1. Habitus photograph of *Edenophorus kynsna* Smith, female (Storms River Village).

Natal Museum, Pietermaritzburg, South Africa (NMSA): Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (ZFMK).

Terms used for adult structures primarily follow those of McAlpine (1981), and for the male terminalia those of Cumming *et al.* (1995) and Sinclair (2000). To facilitate observation, terminalia were macerated in hot 85 % lactic acid and immersed in glycerin. Label data of holotypes are cited in full, with original spelling, punctuation and date; lines are delimited by a slash mark (/), and a semicolon separates data quoted from different labels.

The following abbreviations are used in the descriptions: acr = acrostichal setulae; dc = dorsocentral bristles; dm = discal medial, dm-cu = discal medial-cubital, M = medial vein, npl = notopleural bristles; pal = postalar bristles; ph = posthumeral bristle; pprn = postpronotal bristles; R = radial vein, S = sternite, Sc = subcostal vein, sctl = scutellar bristles, T = tergite.

TAXONOMY

Edenophorus Smith, 1969

Recognition: Distinguished from other Empididae *s.s.* by the proboscis positioned anteriorly, palpus straight and not strongly arched, pair of postpronotal setae (one directed anteriorly and other posteriorly), precoxal bridge with lateral setae, R_{4+5} unbranched, costa strongly reduced beyond R_{4+5}, base of phallus with enlarged sperm chamber, and ejaculatory apodeme stout and enlarged.

Description:

Head: Males holoptic with upper facets enlarged, or dichoptic and facets not enlarged. Antenna with scape bearing short setae dorsally; 3-segmented style: segment 8 short, ring-like, segment 9 3–4 times longer than wide, segment 10 peg-like. Proboscis typical of Empidinae: proboscis arising anteriorly near forward margin of head, length subequal to nearly 2 times height of head. Palpus straight, parallel to proboscis; lacinia long and slender, shorter than hypopharnyx. Labrum slender, straight with pair of apical epipharyngeal blades; apex membranous, lacking epipharyngeal brush; epipharyngeal carina short, present at proximal margin. Hypopharynx very stout, straight, parallel to labrum; salivary pump small. Labellum well developed, produced apically; 7–8 pseudotracheae present. Clypeal ridge slender, three-quarters length of cibarium.

Thorax: Acr present, dc uniserial, 2 or more pprn (lower directed forward, upper directed posteriorly); 1 ph (close to postpronotal lobe); 3 npl; 1 pal; 4 sctl. Antepronotum with pair of short setae. Upper half of anepisternum often with numerous setulae; precoxal bridge with 1–2 stout seta above fore coxa; antepronotum with pair of lateral setae, shorter than occipital setae; laterotergite bare. Legs unmodified, lacking sexual modifications.

Wing: Costa strongly reduced beyond R_{4+5}; Sc incomplete, ending just short of costa; stigma faint, at apex of R_1; R_{4+5} unbranched; cell dm complete or crossvein dm-cu absent; if cell dm absent, M vein weakened.

Abdomen: S8 divided into pair of sclerites.

Terminalia: Epandrial lamellae separate, bearing narrow, apical lobe. Cercus thinly sclerotised, not clasper-like. Hypandrium reduced; gonocoxal apodemes broad, expanded horizontally. Postgonite arising from posterolateral margin of hypandrium, secondarily articulated and/or fused to base of phallus. Ejaculatory apodeme broad, strongly sclerotised, articulated to enlarged sclerotised sperm chamber at base of phallus.

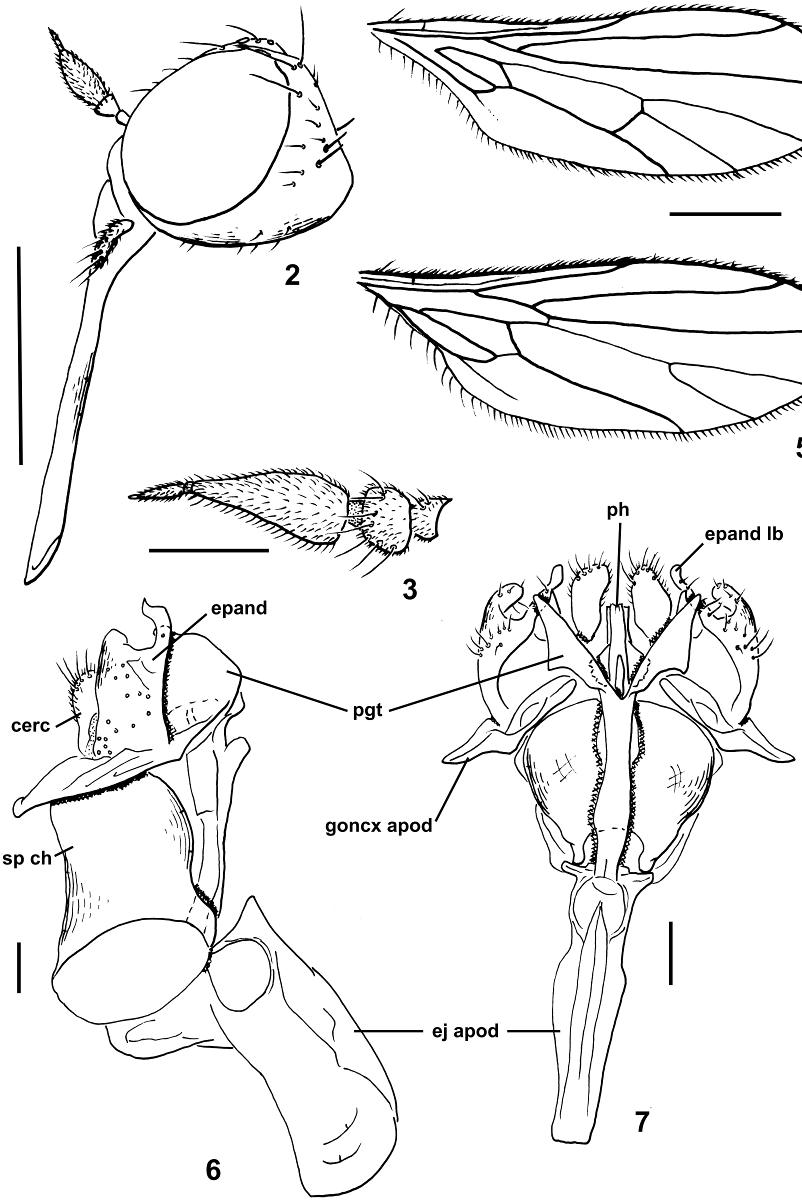
Female: Dichoptic. Terminalia: Single spherical spermathecal receptacle present (viewed through cuticle of specimen of *E. knysna* stored in alcohol, Fig. 1).

Remarks: In Smith's (1969: 129) key to the genera of Southern African Empidinae, *Edenophorus* will key to the genus *Atrichopleura* Bezzi on the basis of an unbranched (= unforked) R_{4+5} and incomplete Sc. If couplet 5 of his key is replaced by the following modification, *Edenophorus* can be easily distinguished:

5 Proboscis arising near anterior margin of head (Fig. 2); postpronotal lobe with at least one anteriorly and one posteriorly directed bristle; palpus straight, lying parallel to proboscis .... **Edenophorus** Smith

– Proboscis arising near middle of head; postpronotal lobe with several slender setae, but not distinctly directed anteriorly and posteriorly; palpus strongly arched dorsally, following the curvature of the lower head margin or gena 5a

5a Wing vein R_{4+5} forked .... **Hilarempis** Bezzi
– Wing vein R_{4+5} unforked .... **Atrichopleura** Bezzi



Figs 2–7. *Edenophorus* characters. 2. *E. spinosus* sp. n., head. 3. *E. hiemalis* sp. n., antenna. 4. *E. knysna* Smith, wing. 5. *E. hiemalis* sp. n., wing. 6–7. *E. irwini* sp. n., male terminalia. 6. Lateral view. 7. Posterior view. Scale bar = 0.1 mm, except Figs 2, 4, 5, where scale bar = 0.5 mm. [Abbreviations: cerc = cercus; ej apod = ejaculatory apodeme; epand = epandrium; epand lb = epandrial lobe; goncx apod = gonocoxal apodeme; pgt = postgonite; ph = phallus; sp ch = sperm chamber.]

Phylogenetic relationships:

As stated in the Introduction, *Edenophorus* was originally assigned to the Microphorinae, but at that time male specimens were unknown. The dorsal mesepimeral pocket is present in *Edenophorus* as described by Ulrich (1994), and it is this feature that provided the first proof that this genus was incorrectly assigned to the Microphorinae (mesepimeral pocket absent in the latter lineage). This pocket is a ground-plan character of the Empididae (*s.s.*), and also occurs, presumably independently, in the Ceratomerinae and Trichopezinae (Ulrich 1994; Daugeron 1997; Sinclair & Cumming, unpubl. data).

Further assignment of this genus within the Empidinae remains problematic. The subfamily has traditionally been divided into two tribes, Empidini and Hilarini. However, this is largely based on narrow palearctic concepts, and many southern hemisphere as well as nearctic taxa (e.g., *Edenophorus*, *Empidadelpha* Collin, *Hesperempis* group, and *Philetus* Melander) can not be easily inserted into this classification. Consequently, a re-evaluation of the higher classification of the Empidinae is urgently required.

On the basis of an incomplete subcosta (Sc), separate epandrial lamellae, and an upwardly curved phallus, *Edenophorus* is assigned to a clade including Hemerodromiinae and most Empidinae, (except *Philetus* and the *Hesperempis* group) (Sinclair & Cumming, unpubl. data). Based on the costa (C) being strongly reduced beyond R$_{4+5}$, *Edenophorus* appears closely related to the clade comprising *Empidadelpha* + Empidini + Hilarini (Sinclair & Cumming, unpubl. data). The latter group is characterised by a strongly arched maxillary palpus, which is straight and not curved in *Edenophorus*.

Key to species of *Edenophorus*

1 Cell dm present, crossvein dm-cu present (Fig. 4) 2
– Cell dm absent, crossvein dm-cu absent (Fig. 5) 4

2 Postpronotal lobe with 3 stout anterior bristles and 1 posterior bristle; length of proboscis at least 1.5 times height of head (Fig. 2) .... **spinosus** sp. n
– Postpronotal lobe with 1 anterior and 1 posterior bristle; length of proboscis slightly longer to less than height of head (Fig. 1) 3

3 Proboscis less than height of head; basal 2 antennal segments yellow, contrasting strongly with dark postpedicel (Fig. 1) .... **knysna** Smith
– Proboscis more than height of head; basal 2 antennal segments slightly paler than dark postpedicel .... **irwini** sp. n.

4 Legs dark .... **nigricans** sp. n.
– Legs pale 5

5 Antenna yellow, except for dark apex of postpedicel and style ..... **hiemalis** sp. n.
– Antenna dark 6

6 M$_1$ strongly arched towards wing margin, divergent from R$_{4+5}$; male terminalia held horizontally, such that the cerci are positioned dorsally (Fig. 9) .... **simplex** sp. n.
– M$_1$ gently arched towards wing margin, not divergent from R$_{4+5}$; male terminalia held upright, such that the cerci are positioned anteriorly (Fig. 10) .... **stuckenbergi** sp. n.

Edenophorus hiemalis sp. n.

(Figs 3, 5, 8)

Etymology: From the Latin *hiemalis* (of winter), in reference to the season in which the holotype was collected.

Holotype male labelled: SOUTH AFRICA: *KwaZulu-Natal*: 'RSA: KwaZulu Natal/ Prov.Karkloof Ra./ 2000m, Howick Distr./ Benvie Farm(Geekie's)/ 8.vii.2001,Podocarp/ for.,B.J. Sinclair' (NMSA).

Recognition: This species is distinguished by the absence of cell dm, proboscis subequal to height of head, and yellow antenna and proboscis.

Description:

Male:

Head: Eyes closely approximated, less than width of scape; facets not enlarged; face and frons with dense mat of fine pale setulae. Antenna yellow, except extreme tip of postpedicel and style; scape and pedicel almost subequal in length; postpedicel conical, clothed in fine pubescence, *ca* 3 times length of pedicel (Fig. 3), gradually tapered to style; style slightly longer than pedicel. Occipital setae pale, biserial, slightly stouter than surrounding setae. Proboscis yellow, slightly shorter than height of head; palpus one-third length of proboscis, slender bearing long, pale setae.

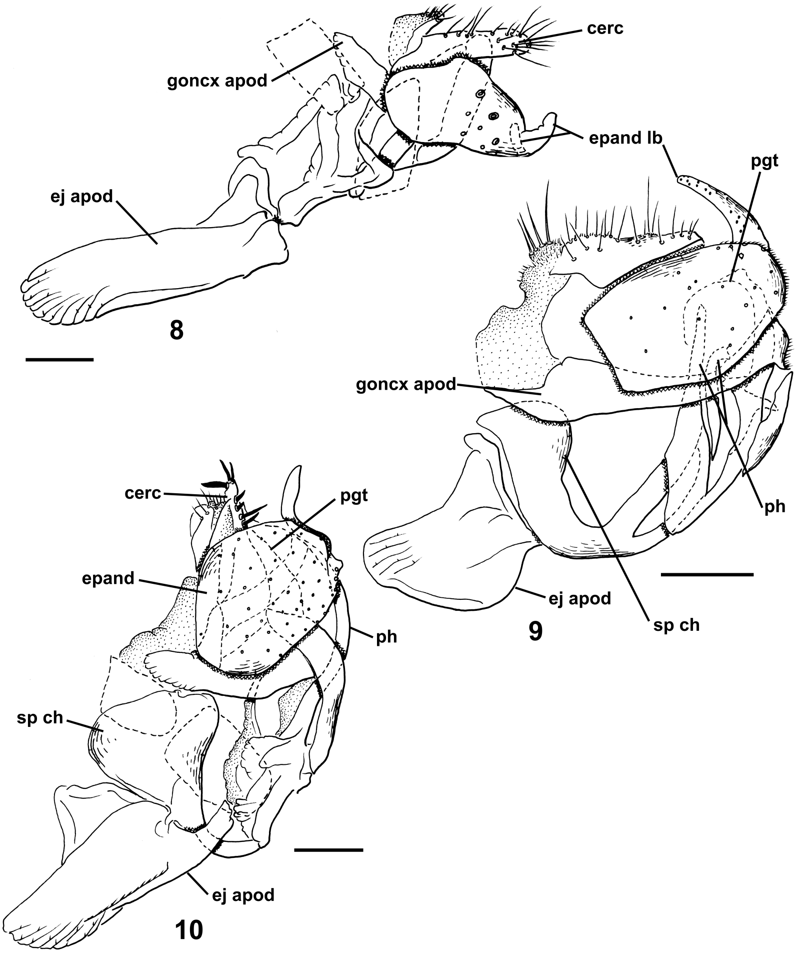
Thorax: Dusted entirely with grey pruinescence. Thoracic setae generally short, slender, pale, reduced to numerous rows: Acr biserial; more than 10 dc, uniserial, gradually increasing in length posteriorly with prescutellar dc stout and similar to pprn; inter-alar setulae scattered, extending to wing base; 2 pprn (lower directed anteriorly, upper directed posteriorly) and several short setulae; 1 ph; 3 npl, upper shortest; 1 pal; 4 sctl, inner pair stouter and twice length of outer pair. Antepronotum with 1 pair of short, slender setae; upper half of anepisternum with several pale setulae; precoxal bridge with 1 stout seta above fore coxa.

Legs: Pale yellow (concolorous with halter), apical tarsomeres darker. Fore coxa with with 4–6 stout, long, lateral pale setae; segments clothed in fine setulae, lacking modified setae.

Wings (length 2.0 mm) (Fig. 5): Stigma indistinct. Venation similar to other species, except crossvein dm-cu absent; M vein reduced in strength, medial fork U-shaped, petiole or stem slightly shorter than fork; M_1 not strongly arched towards wing margin, slightly divergent from R_{4+5}. Halter yellow.

Abdomen: Dusted greyish brown, pale brown, paler than thorax. T8 broad, one-half length of preceding tergite; S8 divided into pair of rounded, lateral sclerites, articulated posteriorly to anterolateral corner of S7.

Terminalia (Fig. 8): Held horizontally, cercus dorsal; partially retracted into segment 8. Cercus finely sclerotised, finger-like. Apex of epandrium with pair of finger-like lobes projected medially. Hypandrium reduced. Phallus with enlarged basal sperm chamber; ejaculatory apodeme inverted T-shaped, broad, stout, articulated at base of chamber, subequal to length of terminalia. Postgonite cylindrical, with rounded tip, arising ventrally from near base of phallus, extended to tip of phallus.



Figs 8–10. *Edenophorus* male terminalia, lateral view. 8. *E. hiemalis* sp. n. 9. *E. simplex* sp. n. 10. *E. stuckenbergi* sp. n. Sclerites of segment 8 marked by dashed outline (not shown in Fig. 9). Scale bar = 0.1 mm. [Abbreviations: cerc = cercus; ej apod = ejaculatory apodeme; epand = epandrium; epand lb = epandrial lobe; goncx apod = gonocoxal apodeme; pgt = postgonite; ph = phallus; sp ch = sperm chamber.]

Female: Unknown.

Remarks: A photograph of the type locality is found in Smith (1969, fig. 415). Much of the slope is now planted with exotic trees, but the *Podocarpus* forest remains, although reduced in size, surrounding a small stream. This site supports a rich empidoid fauna, but it is most diverse in the early summer months. The holotype was swept from short vegetation growing over the stream bank.

Edenophorus irwini sp. n.

(Figs 6, 7)

Etymology: Named in honour of the collector, Mike E. Irwin, who has contributed greatly to the knowledge of South African Diptera.

Holotype male labelled: SOUTH AFRICA: *KwaZulu-Natal*: 'South Africa, Natal Prov/ Karkloof Range,near Mt/ Alida; temp.forest assoc/ 17 June 1974, near pond/ ME Irwin (2930Ab)' (NMSA).

Recognition: This species is distinguished by its short proboscis, presence of cell dm, and the enormous, erect male terminalia, with their cerci positioned anteriorly.

Description:

Male:

Head: Eyes nearly touching above antennae; facets above antennae enlarged; setulae on face; 4 pairs of setulae on frons, upper-most longest. Antenna with basal segments slightly paler than the postpedicel; scape very short, pedicel globular with fringe of setulae; postpedicel conical, clothed in fine pubescence; twice length of pedicel, gradually tapered to style. Stout occipital setae in several rows. Proboscis light brown, slightly longer than height of head; palpus one-quarter length of proboscis, pointed bearing long, pale setae.

Thorax: Dusted entirely with brownish grey pruinescence. Thoracic setae generally short, reduced to numerous rows: Acr biserial; dc uniserial, with 4 pairs of long bristles at prescutellar depression; inter-alar setulae scattered, extending to wing base; 2 pprn (lower directed forward, upper directed posteriorly) and numerous short setulae; 1 ph; 3 npl, posterior bristle short; 1 pal; 4 sctl, inner pair stronger, nearly twice length of outer. Antepronotum with 1 pair of short, stout setae. Upper half of anepisternum with greater than 10 setulae; precoxal bridge with 1 stout seta above fore coxa.

Legs: Yellowish, darker on apical tarsal segments; clothed in fine setulae, lacking modified setae; fore coxa with 1–2 pairs of long pale lateral setae on lower half, longer than width of coxa.

Wings (length 2.4 mm): Stigma faint. Venation similar to *E. knysna*; cell dm present. Halter yellowish brown.

Abdomen: Pale brown, concolorous with thorax. T8 membranous, S8 divided into 2 small square sclerites.

Terminalia (Figs 6, 7): Held upright, greatly enlarged compared to abdomen, cercus anterior; cercus and epandrium yellowish. Cercus thinly sclerotised, setose. Epandrium with slightly twisted finger-like lobe on inner margin. Hypandrium reduced. Phallus with large basal, inflated sperm chamber; apex encircled by subapical toothed crown; ejaculatory apodeme broad, stout, articulated at base of chamber, one-third length of terminalia. Postgonite triangular in posterior view, divergently encircling tip of phallus; fused posteriorly with base of phallus.

Female: Unknown.

Additional material examined: Paratypes: SOUTH AFRICA: *KwaZulu-Natal*: 4 males, same data as holotype (NMSA).

Edenophorus knysna Smith

(Figs 1, 4)

Edenophorus knysna Smith, 1969: 309.

Recognition: This species is distinguished by its yellow scape and pedicel, presence of cell dm, and proboscis shorter than height of head.

Diagnosis: Scape and pedicel yellow, postpedicel and style brown (Fig. 1); proboscis slightly shorter than head; precoxal bridge with 1 stout seta above fore coxa; legs and halter yellow, apical leg segments becoming darker; cell dm present (Fig. 4); abdomen paler than thorax, sclerites thinly sclerotised.

Material examined: SOUTH AFRICA: *Western Cape*: female holotype (NMSA), female paratype (BMNH), Garden of Eden Forest, Knysna District, 10.x.1959, B. & P. Stuckenberg. *Eastern Cape*: 1 female, Storms River Village, 33°55'S 23°55'E, 9.ix.1992, B. R. Stuckenberg (ZFMK alc. coll.).

Remarks: The most recently collected specimen was swept from stream-bank ferns in a humid forest.

Edenophorus nigricans sp. n.

Etymology: Named in reference to its blackish or dark body colouration.

Holotype female labelled: SOUTH AFRICA: *Western Cape*: 'SOUTH AFRICA, CAPE PROV./ 2mi.NNE.Pakhuis Farm,/ Pakhuis Mts,Sept. 14, 1972/ ME&BJ.Irwin, 1800ft,3219Aa' (NMSA).

Recognition: This species is distinguished by the absence of cell dm, dark grey thorax, dark legs, and wing with a very faint V-shaped medial fork and short stem.

Description:

Female:

Head: Eyes widely separated above antennae; facets not enlarged; long setulae on face; 4–5 pairs of long subequal setulae on frons. Antenna dark brown; scape subequal in length with pedicel; postpedicel conical, clothed in fine pubescence, *ca* 3 times length of pedicel, gradually tapered to style, which is shorter than length of pedicel. Stout occipital setae in single arching outer row. Proboscis brown with slightly paler labellum; slightly shorter than height of head; palpus one-third length of proboscis, slender bearing long, pale setae.

Thorax: Lightly dusted entirely with grey pruinescence. Thoracic setae generally short, slender, pale, reduced to numerous rows: Acr biserial; more than 10 dc, uniserial, gradually increasing in length posteriorly with prescutellar dc stout similar to pprn; inter-alar setulae scattered; 2 pprn (lower directed anteriorly, upper directed dorsomedially) and several short setulae; 1 ph; 3 npl; 1 pal; 4 sctl, inner pair stouter, twice length of outer. Antepronotum with 1 pair of short, stout setae; upper half of anepisternum obscured by pin; precoxal bridge with 1 stout seta above fore coxa.

Legs: Dark, reddish brown. Fore coxa with several long lateral setae; segments clothed in pale setulae, lacking modified setae.

Wings (length 2.0 mm): Stigma faint. Venation similar to other species, except crossvein dm-cu absent; M vein very faint, medial fork V-shaped, petiole or stem *ca* one-third as long as fork; M_1 not strongly arched towards wing margin, slightly divergent from R_{4+5}. Halter yellow.

Abdomen: Dusted greyish brown, paler than thorax. Sclerites well sclerotised.

Terminalia (undissected): cercus *ca* half length of T7, slender, finger-like.

Male: Unknown.

Remarks: Although it is often not recommended to base new species of empidids upon female specimens alone, the dark coloured legs and form of the medial fork of this species set it apart from all other known members of the genus.

Edenophorus simplex sp. n.

(Fig. 9)

Etymology: Named in reference to its relatively simple male terminalia.

Holotype male labelled: SOUTH AFRICA: *Western Cape*: 'SOUTH AFRICA, CAPE PROV./ 17mi.N. Vanrhynsdorp at/ fork of Geelsbek & Sout/ Rivers,Sept.10,1972/ ME&BJ.Irwin, 3118Bc,280ft [left wing absent]' (NMSA).

Recognition: This species is distinguished by the absence of cell dm, short proboscis, and male terminalia which are held horizontally, such that the cerci are dorsal in position.

Description:

Male:

Head: Eyes widely separated above antennae; facets not enlarged; setulae on face; 4 pairs of short setulae on frons, upper-most longest. Antenna dark, basal segments concolorous with postpedicel; scape very short, pedicel globular and nearly subequal in length to scape; postpedicel conical, clothed in fine pubescence, *ca* 4 times length of pedicel, gradually tapered to style, which is subequal to length of pedicel. Occipital setae in single arching outer row, slightly more stout than surrounding setae. Proboscis brown with pale labellum; nearly subequal in length to height of head; palpus one-third length of proboscis, slender, bearing long, pale setae.

Thorax: Dusted entirely with grey pruinescence. Thoracic setae generally short, slender, reduced to numerous rows: Acr biserial; more than 10 dc, uniserial, gradually increasing in length posteriorly with prescutellar dc stout similar to pprn; inter-alar setulae scattered, extending to wing base; 2 pprn (lower directed anteriorly, upper directed dorsally) and several short setulae; 1 ph; 2–3? npl; 1 pal; 4–5 sctl, inner 2 pairs subequal. Antepronotum with 2 pairs of short, slender setae; upper half of anepisternum obscured by pin; precoxal bridge with 1 stout seta above fore coxa.

Legs: Pale yellow (concolorous with halter), apical tarsomeres darker. Fore coxa lacking long lateral setae; segments clothed in fine setulae, lacking modified setae.

Wings (length 2.4 mm): Stigma faint. Venation similar to other species, except crossvein dm-cu absent; M vein faint, medial fork U-shaped, petiole or stem slightly shorter than fork; M_1 strongly arched towards wing margin, distinctly divergent from R_{4+5}. Halter yellow.

Abdomen: Dusted greyish brown, concolorous with thorax. T8 membranous, S8 one-third width of previous segment, divided into pair of lateral sclerites.

Terminalia (Fig. 9): Held horizontally, cercus dorsal. Cercus heavily sclerotised, ventral surface flattened and expanded to base of phallus. Epandrial lobe finger-like, slender, arched dorsally. Hypandrium subdivided laterally, exposing phallus; gonocoxal apodemes broad and flattened. Phallus heavily sclerotised, strongly arched; base of phallus (sperm chamber) expanded to enclose broad base of ejaculatory apodeme. Postgonite with broadly rounded apex, encircling phallus.

Female: Unknown.

Remarks: Pollen grains were observed in the dissected and cleared abdomen of the holotype.

Edenophorus spinosus sp. n.

(Fig. 2)

Etymology: Named in reference to the stout postpronotal bristles.

Holotype female labelled: SOUTH AFRICA: *Western Cape*: 'Pakhuis Pass, 950m/ Clanwilliam District/ South-West Cape/ 17–19 October 1964/ B & P Stuckenberg [all caps]' (NMSA).

Recognition: This species is distinguished by the long proboscis (*ca* 1.5 times height of head), four postpronotal bristles, and presence of cell dm.

Description:

Female:

Head: Eyes widely separated above antennae; facets not enlarged; face bare; 4 pairs of setulae on frons, upper-most longest. Antenna with basal antennal segments nearly concolorous with postpedicel; scape short, pedicel globular and longer than scape; postpedicel conical, clothed in fine pubescence, greater than twice length of pedicel, gradually tapered to style, which is slightly longer than pedicel. Stout occipital setae in single arching outer row. Proboscis (Fig. 2) dark brown, at least 1.5 times height of head; palpus one-quarter length of proboscis, slender, bearing long, pale setae.

Thorax: Greyish brown, dusted with grey pruinescence, except anterior margin of scutum bare, shiny with narrow median pruinescent stripe. Thoracic setae generally short and stout, reduced to numerous rows: Acr biserial; at least 12 dc, uniserial, gradually increasing in length posteriorly with prescutellar dc stout, similar to pprn; inter-alar setulae shorter than dc extending to wing base; 4 pprn (lower 3 directed forward, upper 1 directed dorsally) and several short setulae; 1 ph; 3 npl, posterior bristle short; 1 pal; 4 sctl, inner pair stronger, twice length of outer. Antepronotum with 1 pair of short, stout setae. Upper half of anepisternum with several greyish setulae; precoxal bridge with 1–2 stout setae above fore coxa.

Legs: Fore coxa yellow, mid and hind coxae yellowish brown; remaining segments brownish yellow. Fore coxa with several pale lateral setae, slightly shorter than width of coxa; remaining segments clothed in fine setulae, lacking modified setae.

Wings (length 2.7 mm): Stigma faint. Venation similar to *E. knysna*; cell dm present. Halter yellowish brown.

Abdomen: Brown, bearing short, pale setae; apex truncate.

Terminalia (undissected): cercus short, slightly longer than wide.

Male: Unknown.

Remarks: Again, as in *E. nigricans*, it is not usually recommended to base new species of empidids upon female specimens alone. However, the presence of four postpronotal bristles and the greatly lengthened proboscis appear unique among species of this genus, and are likely not to be sexually dimorphic features.

Edenophorus stuckenbergi sp. n.

(Fig. 10)

Etymology: Named in honour of the collector, Brian R. Stuckenberg, who has collected innumerable other new taxa from South Africa.

Holotype male labelled: SOUTH AFRICA: *Western Cape*: 'Sevenweekspoort/ Laingsburg Dist/ West. Cape Prov/ 19–22 Sept 1959/ B. & P. Stuckenberg [head, left wing missing] [all caps]' (NMSA).

Recognition: This species is distinguished by the absence of cell dm, pale legs, and male terminalia with sharp, blade-like setae arising from the cerci, and with the epandrial lobe strongly bent at mid-length.

Description:

Male:

Head: Missing in holotype.

Thorax: Dusted entirely with grey pruinescence. Thoracic setae generally short, slender, pale, reduced to numerous rows: Acr biserial; at least 9 dc, uniserial, gradually increasing in length posteriorly with prescutellar dc stout, similar to pprn; inter-alar setulae scattered, extending to wing base; 2 pprn (lower directed anteriorly, upper directed dorsomedially) and several short setulae; 1 ph; 3 npl, upper shortest; 1 pal; 4 sctl, inner pair stouter and twice length of outer pair. Antepronotum with 2 pairs of short, pale setae; upper half of anepisternum obscured by pin; precoxal bridge with 2 setae above fore coxa.

Legs: Pale yellow (concolorous with halter), apical tarsomeres darker. Fore coxa with with several stout, long, lateral pale setae; segments clothed in fine pale setulae, lacking modified setae.

Wings (length 1.6 mm): Stigma indistinct. Venation similar to other species, except crossvein dm-cu absent; M vein reduced in strength, medial fork U-shaped, petiole or stem slightly shorter than fork; M_1 not strongly arched towards wing margin, nearly parallel with R_{4+5}. Halter yellow.

Abdomen: Lightly dusted greyish brown, concolorous with scutum. T8 broad, one-half length of preceding tergite; S8 divided into pair of rounded, lateral sclerites, not articulated with T7.

Terminalia (Fig. 10): Held upright, cercus anterior; partially retracted into segment 8. Cercus thickly sclerotised, with 3 stout apical setae and posterior row of 4 blade-like, pointed setae. Epandrium with finger-like lobe projected dorsally, sharply bent at mid-length. Hypandrium reduced to series of slender sclerites; hypandrial bridge broad, with greatly expanded, horizontally projected gonocoxal apodemes. Phallus with enlarged basal sperm chamber; ejaculatory apodeme inverted Y-shaped, broad, stout, articulated at base of chamber, subequal to one-half length of terminalia. Postgonite tapered to small rounded apex, extended ventrally to near base of phallus.

Female: Uncertain (see Remarks).

Additional material examined: SOUTH AFRICA: *Northern Cape*: 1 female, Nieuwoudtville Area, Calvinia District, 14.x.1964, B.& P. Stuckenberg (NMSA).

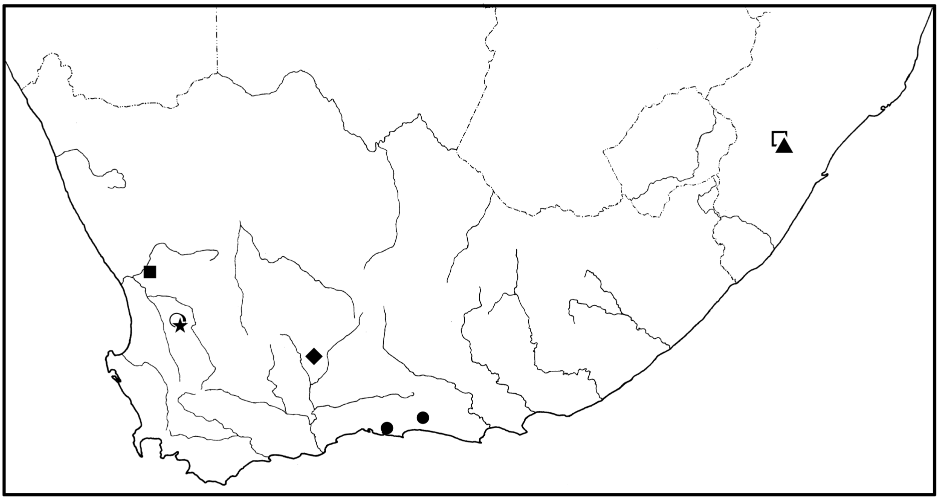


Fig. 11. Known distribution of species of *Edenophorus*. □ = *E. hiemalis* sp. n., ▲ = *E. irwini* sp. n., ● = *E. knysna* Smith, ★ = *E. nigricans* sp. n., ■ = *E. simplex* sp. n., ○ = *E. spinosus* sp. n, ◆ = *E. stuckenbergi* sp. n.

Remarks: The female specimen is not included in the type series, although it is possibly conspecific based on the wing venation. A male from this locality would help to clarify the identity of this specimen.

ZOOGEOGRAPHY

Distribution

Although based on very few records, this genus exhibits a common empidoid distribution in South Africa. It is primarily confined to east and south of the Great Escarpment, and to the Cape Fold Belt (Fig. 11). Similar patterns are also illustrated in Smith (1969) and Sinclair (1996).

The genus occurs in two widely separated areas, though this may be a collecting artefact. The two species in KwaZulu-Natal were found at the same place, and in mid-winter (June/July), when collecting of Diptera is not normally undertaken. The locality has been visited frequently over many years in spring and summer by numerous Diptera collectors.

The two known localities for *E. knysna* are damp sites within indigenous forests. The other species of the SW Cape come from completely different habitats. Both *E. spinosus* and *E. nigricans* were found in the Pakhuis section of the Cederberg Range, an area with a rich Fynbos montane shrubland flora and no forest. *Edenophorus stuckenbergi* was also from montane sites with Fynbos. The dipteran fauna of Fynbos is rich in endemics, and the influence of the winter-rainfall regime is marked, with most of the insect fauna emerging in early spring when the flora comes into flower (Stuckenberg, pers. comm.). The type locality of *E. simplex* in southern Namaqualand is very different. This locality is in a highly distinctive region known as the Knersvlakte. It is an arid terrain of sandy flats and low, rounded hills; rainfall usually is less than 150 mm per annum, and the flora is low, shrubby, and dominated by succulents with a very high level of endemicity. Although the type locality was stated to be at the confluence of two rivers, these in fact are dry sandy watercourses that rarely and then only briefly have water in them (Stuckenberg, pers. comm.).

Gondwanan taxon

The rarity of *Edenophorus*, with only 14 specimens obtained in over 40 years of intensive collecting of flies in many parts of South Africa, suggests small, highly localised populations, with the adult stage limited to brief periods. Nevertheless, the mid-winter presence of adults in the Karkloof suggests a relict status. This scenario is similar to the apparently gondwanan rhagionid genus *Atherimorpha* White, in which some species have been found only in winter, including one collected by the author together with *E. hiemalis*.

On the basis of the above discussion, and given its proposed sister-group relationship with the clade *Empidadelpha* + Empidini + Hilarini (see Phylogenetic relationships), *Edenophorus* should be classified as a gondwanan element. It is unrelated to any other African or palearctic Empidinae, and *Empidadelpha* is presently known only from Chile, New Zealand and Australia.

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REFERENCES

Chvála, M. 1981. Classification and phylogeny of Empididae, with a presumed origin of Dolichopodidae (Diptera). *Entomologica Scandinavica Supplement* **15**: 225–236.

Cumming, J. M., Sinclair, B. J. & Wood, D. M. 1995. Homology and phylogenetic implications of male genitalia in Diptera - Eremoneura. *Entomologica Scandinavica* **26**: 121–151.

Daugeron, C. 1997. Evolution of feeding and mating behaviours in the Empidoidea (Diptera: Eremoneura). *In*: Grandcolas, P., ed., The origin of biodiversity in Insects: Phylogenetic tests of evolutionary scenarios. *Mémoires du Muséum National d'Histoire Naturelle* **173**: 163–182.

McAlpine, J. F. 1981. Morphology and terminology - adults. [Chapter] 2. *In*: McAlpine, J. F. *et al.*, eds, *Manual of Nearctic Diptera*, Vol. 1. *Agriculture Canada Monograph* **27**: 9–63.

Sinclair, B. J. 1996. Revision of the southern Africa genus *Acarterus* Loew (Diptera: Empidoidea; Hybotinae), with description of seven new species. *Annals of the Natal Mus*eum **37**: 215–238.

——— 2000. Morphology and terminology of Diptera male terminalia. *In*: Papp, L. & Darvas, B., eds, *Contributions to a Manual of Palaearctic Diptera*, Vol. 1. General and Applied Dipterology. Budapest: Science Herald pp. 53–74.

Smith, K. G. V. 1969. The Empididae of southern Africa (Diptera). *Annals of the Natal Museum* **19**: 1–342.

Ulrich, H. 1994. A likely autapomorphy of the Empididae, and evidence for the systematic placement of *Edenophorus* Smith. *In*: O'Hara, J. E., ed., *Third International Congress of Dipterology, Abstract Volume*. Guelph, Canada p. 230.